University of North Carolina at Chapel Hill
Duke Univeristy
North Carolina Occupational Safety and Health Education and Research Center
Annual Program Highlights
Reporting Period: July 1, 2012 – June 30, 2013
Principle Investigator: Bonnie Rogers

Center Highlights

Continuing Education and Outreach
Program Director: Kathleen Buckheit

During the fiscal year of July 1, 2012 through June 30, 2013, NC OSHERC has provided 155 continuing education and training programs for 4721 participants from all disciplines of occupational and environmental safety and health areas. Several collaborations with the other ERCs in the Southeast region have continued. to be fulfilling and successful. As a result of training received, students report that they have been able to work more safely and maintain OSHA and EPA compliance for their businesses; many have received promotions because of the education received and the Technician Certificate Programs completed. A significantly higher than national passing rates for all the Certification Review Programs offered has been consistently achieved.

Outreach for all of the NC OSHERC Programs is extensive and involves national and many local and state chapters of professional associations touching thousands of occupational safety and health professionals and workers of all kinds, including:

1. American Society of Safety Engineers (ASSE) - education committees, presenters, loan equipment, and provide resources;
2. 2. American Association of Occupational Health Nurses (AAOHN) - many committees, Board of Directors, loan equipment, provide resources, presenters, and regular journal contributions;
3. American Industrial Hygiene Association (AIHA) - education committees, presenters, loan equipment, and provide resources;
4. Association of Occupational Health Professionals (AOHP) - education committee, presenters, loan equipment, resources;
5. Academy of Certified Hazardous Materials Managers (ACHMM) - education committee; presenters, loan equipment, resources;
6. Human Factors Society (HFS) - educational committee, and presenters
7. International Commission on Occupational Health (ICOH) - ICOH Vice-President, Secretary of Scientific Committee on OHN; Epidemiology, presenters, and committees and Chairs
8. Association of Occupational and Environmental Clinics (AOEC) - several committees;
9. NIOSH Board of Scientific Counselors - Chair;
10. Institute of Occupational Medicine (IOM) - several committees and Chair;
11. Health Physics Society (HFS) - educational committee, presenter;
12. NC A & T State University - Occupational Safety Advisory Board member, provide resources, and CE for faculty and students;
13. NC EMS Rapid Response Team (RRT) - Advisory Board;
14. National Personal Protective Technology Lab (NPPTL) - Respiratory Protection committees;
15. American College of Occupational and Environmental Medicine (ACOEM) - education committee, presenters, loan equipment;

16. Publications per year - approximately 50; and
17. Presentations per year - approximately 60.

OSE Program Area faculty and students provided many tours of cognitive and physical ergonomics lab, including description of on-going funded research projects and relevance to 1) commercial insurance industry; 2) as a basis for identification of directions of collaborative research opportunities with other universities (University College of London, Khon Kaen University, and University of Rostock); 3) for high school students and parents interested in NC State undergraduate engineering programs participating in the COE Open House every year; and 4) to familiarize ergonomics training class attendees with various types of ergonomics research instrumentation.

Occupational Exposure Science
Program Director: Leena A. Nylander-French

Raju Prasad, OES trainee, and Dr. Rebecca Fry have published new research findings on genotoxicity of titanium dioxide nanoparticles. Several toxicological studies have shown that titanium dioxide nanoparticles (nano-TiO2), one of the most widely produced engineered nanoparticles, can induce genotoxicity. However, potential adverse health effects associated with their physicochemical properties are not fully understood. Proteins in a biological medium can adsorb to the surface of the nanoparticle resulting in the formation of a protein corona that can alter the physicochemical properties of the particle. Furthermore, the protein corona may impact the interaction between nanoparticles and cells, referred to as the nano-bio interface, effecting the uptake, distribution, and toxicity of the particles.

Prasad has discovered that (1) protein corona formation on the surface of nano-TiO2 can impact the nano-bio interface and change cellular interaction, (2) smaller agglomerates of nano-TiO2 are taken up more by cells without inducing cell cycle arrest, thereby allowing induced DNA damage to be processed into micronuclei in BEAS-2B cells, and (3) nano-TiO2 in medium that facilitates increased cellular interaction induces the upregulation of the ATM-Chk2 DNA damage response (similar to ionizing radiation) and NF-κB inflammation pathways. Prasad's research provides a systematic examination of the physicochemical properties, genotoxicity, and cellular responses induced by titanium dioxide nanoparticles. This study also shows that there is limited ability to make a general prediction regarding the in vitro genotoxicity of titanium dioxide nanoparticles without understanding further the toxicological implications of the nano-bio interface.

Kyle Messier, OES Trainee, received 2013 Graduate Education Advancement Board Impact Award Recipient for research benefiting the state of North Carolina. Messier and Dr. Serre's research has resulted in a breakthrough that has allowed the first successful space/time modeling analysis of groundwater tetrachloroethylene (PCE) contamination across the State of North Carolina. PCE, a likely carcinogen to humans, is a dry cleaning agent and metal degreaser that contaminates the groundwater in many areas across North Carolina. PCE's distribution across the state is uncertain because monitoring is localized around known contaminant plumes. Messier has created a way to analyze groundwater contamination from PCE by integrating the following: address geocoding of private well data, land-use regression that accounts for point sources and flow direction, "below detect"-data modeling, and geostatistics. Messier obtained more than 2,400 new ground water PCE measurements in North Carolina through his address geocoding process. This technique alone more than quadruples the amount of groundwater PCE data available to regulators in North Carolina for making decisions related to PCE exposure. This study provides a cost-effective, efficient and more accurate methodology for estimating exposure of North Carolinians to hazardous contaminants, which ultimately leads to better public health protection of its citizens.

Occupational Epidemiology
Program Director: David Richardson

Over the last year Program Director, David Richardson, has served on the following: Presidential Advisory Board on Radiation and Worker Health (US Presidential Appointment); Science Advisory Board, Radiation Advisory Committee, U.S. Environmental Protection Agency; and two Committees of the Institute of Medicine (Committee on Research Directions in Human Biological Effects of Low Level Ionizing Radiation; and, Committee on Review of the Department of Labor's Site Exposure Matrix Database). He served on the Scientific Committee of the 23rd Conference on Epidemiology in Occupational Health (EPICOH 2013) and delivered a keynote address there.

Trainee Alex Keil received the Marilyn and Al Tyroler Endowed Scholarship in Epidemiology (2013) and Kim Angelon Gaetz received an EPA Star Fellowship (2011-2013). Using Training Grant pilot project funds, occupational epidemiology student Leah Schinasi reported on a high-impact study, recently published in PLOS ONE, based on her dissertation project studying environmental and occupational exposures associated with methicillin resistant Staphylococcus aureus nasal carriage in patients admitted to an eastern North Carolina hospital.

Occupational Health Nursing
Program Director: Bonnie Rogers

Bonnie Rogers was funded by National Personal Protective Technology Laboratory (NPPTL) to develop, implement, and evaluate an education and practice intervention that incorporates both knowledge and practice components for respiratory protection in a sample of the previously participating NC 21 hospitals. Utilization of key personnel in the healthcare facilities will be an integral component.

In this project, we developed an educational program for Health Care Workers (HCWs) and management that incorporated core elements related to respiratory protection for influenza including:

- Influenza transmission routes, hand hygiene, the value of respiratory protection in reducing illness and injury
- Hazard assessment, respirator selection and care
- Medical evaluation and monitoring
- Fit testing, training, donning/doffing, seal checks, and return demonstration
- Program evaluation

We conducted focus groups to identify barriers to effective integration of respiratory protection into practice and key core competencies for respiratory protection practice. Twelve Practice Champions were identified to provide guidance on respiratory protection. The impact will be to improve practice for respiratory protection using core competencies as a guide for practice for all health care workers.

The NC OSHERC NORA Interdisciplinary Seminar Series continues to be offered quarterly and are well received by almost 500 individuals annually. Many attendees state that the seminars are valuable in that new and interesting material is presented that can impact practice; webcast and archive link provides ability for participants to access the information without having to travel. A growing number of attendees are from Canada and other countries.

Occupational Medicine
Duke University
Program Director: Dennis Darcey

Documenting Medicine," is a program which pairs Duke Physician residents and fellows with documentarians at Duke's Center for Documentary Studies to produce small documentary projects exploring medical stories over the course of nine months. These projects are then shared in Grand Rounds, conferences, poster sessions, exhibits, community educational events and other venues. Occupational Medicine Residents Thomas Bender and Cynthia Feltner completed documentary films that were presented at the ACOEM Regional Meeting in August 2012 and the American Public Health Association meeting in October 2012.

Dr. Bender's film illustrates the impact of an outbreak of hepatitis B at an assisted living facility and why the policy changes adopted in North Carolina should be emulated elsewhere. http://vimeo.com/43288991

Dr. Feltner' s film examines how work culture and local community economics can influence injury reporting by exploring one coal miner's experience following a work-related injury. http://vimeo.com/42133350

Hester Lipscomb's research on nail gun injury: translation of research to practice led to changes in nail gun manufacturer safety improvements on gun triggers, OSHA Alert and OSHA and Duke CPWR web sites to educate workers and employers.

Nail Gun Safety: The Facts. The Duke University and Center for Construction Research and Training (CPWR). Provides information to prevent worker injuries from nail guns as well as nail gun research and training articles. http://www.nailgunfacts.org/index.php?option=com_content&view=section&layout=blog&id=1&Itemid=9

OSHA outreach
https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=news_releases&p_id=20697
https://www.osha.gov/doc/topics/nailgun/

Occupational Safety and Ergonomics
Program Director: David Kaber

This past year the OSE Program Area produced one of the highest number of archival publications in any year of operation of the program. Topics ranged from assessing driver distraction due to on-road signage and design of aircraft cockpit displays of traffic information to the use of haptic control devices and virtual reality simulation for training of fine-motor skills as well as development of measures of cockpit display clutter. NIOSH-supported trainees contributed to eight (8) journal articles and five (5) conference proceedings papers. Worth highlighting are the contributions of one particular trainee, Mr. Michael Clamann. Michael was a co-author on three journal articles and author or co-author on three conference papers. Michael's project research has focused on the design and development of virtual reality simulation features for accelerating and increasing the degree of motor learning through simulation-based training tasks. Michael published one paper in the Journal of Assistive Technology on evaluation of augmented virtual reality for psychomotor task training. In addition, Michael took the initiative to analyze project datasets from different perspectives than originally proposed to funding agencies and to develop new theories for explaining human behavior. In specific, he

published a paper through the Human Factors & Ergonomics Society demonstrating a relation between human perceptual style and accuracy in a block design reconstruction task. Michael has also taken a lead in publishing work primarily performed by other students. That is, some graduate students in our program have prepared theses and dissertations but have not followed-through with publication of their research. Michael previously supported these students in their empirical work and he saw an opportunity to turn this effort in to publications to expand his research record and potential for employment in academia. Michael prepared manuscripts based on the research and has been successful in publishing several journal articles with appropriate authorship for the other students. This type of effort is rare among PhD students and demonstrates Michael's true interest in making contributions to human factors science.